

Soil patchiness, root growth and root–shoot partitioning (Botanical Briefing)

Recent ecological investigations reveal striking effects of environmental heterogeneity on plants, their populations and communities. **Hutchings and John (pp. 1–8)** discuss the effects of plant-scale soil-based heterogeneity on root growth and biomass partitioning between roots and shoots, and advocate more research into the impacts on plant behaviour of heterogeneous resource supply.



Cell theory revised (Invited Review)

Cell Theory is one of the most influential paradigms current in biology. However, the existence of cell-to-cell channels linking plant cells together is at variance with this version of Cell Theory. **Baluška et al. (pp. 9–32)** review extensive data suggesting that the DNA-based nucleus and its associated tubulin-based microtubules form the *Cell Body* and represent the smallest autonomous and self-reproducing unit of eukaryotic life.



Impact of stigma morphology on breeding systems

Sigrist and Sazima (pp. 33–41) combine scanning electron microscopy, pollen tube growth measurements and floral visitor records to assess links between

stigma characteristics and pollination biology of 12 Brazilian species of the Malpighiaceae. All are shown to be pollinator-dependent and this is linked to the oil and pollen collecting behaviour that favours rupture of the stigmatic cuticle and pollen deposition.



Self-sterility can arise from inbreeding depression

Illicium floridanum, a relictual species within a paraphyletic group comprising the first three branches of angiosperm phylogeny, is highly self-incompatible. Unexpectedly, **Koehl et al. (pp. 43–50)** find that pollination by cross- and self-pollen results in similar rates of fertilization and pollen tube growth. Hence, pre-zygotic stigmatic self-incompatibility is absent in *I. floridanum*, suggesting that self-sterility is due to early-acting inbreeding depression.



Building the leaf vasculature

Vascular tissue in dicot leaves is assumed to develop from tissue in which it is embedded. By investigating the distribution of chlorophyllous patches associated with vascular tissue in a GWG chimera of *Ficus rubiginosa*, **Beardsell and Norden (pp. 51–58)** show that bundle sheaths are derived from the outer meristematic layer and displace tissue from two other layers.



Growth rings revealed in mangrove trees

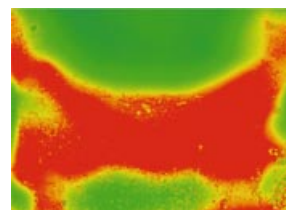
Tree ring analysis is a powerful tool for investigating age, growth rates and yield of trees. In addition, it may help to detect past changes in environmental conditions and to understand forest dynamics.

Verheyden et al. (pp. 59–66) re-evaluate the reported absence of growth rings in mangrove trees and discover that indistinct annual growth rings are present in *Rhizophora mucronata*.



Early events in genetic transformation of citrus explants

Competence for regeneration and for transformation is not always found in cultures of the same cell type or stage of development. **Peña et al. (pp. 67–74)** show that, in citrus explants, treatments that increase the rate of division by cambial cells in S phase lead to many more stably transformed cells and regenerated transgenic plants.



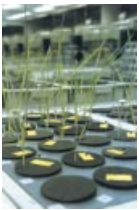
Glucose in maize ovaries

Ovaries need a consistent supply of glucose at the time of pollination to prevent abortion. By localizing glucose and invertase activities in plants subjected to low water potentials, **McLaughlin and Boyer (pp. 75–86)** establish a link between a glucose gradient, invertase activity, and ovary abortion.



Cassava disease resistance

Although microbial diseases of cassava are most effectively controlled by resistant genotypes, defence mechanisms of this major, staple tropical crop are poorly understood. **Gómez-Vásquez *et al.* (pp. 87–97)** examine phenylpropanoids and associated enzymes as potential defence components. They show that microbial elicitors trigger induction of phenylalanine ammonia-lyase, peroxidases and co-substrate peroxide. They also identify several major phenolics and show their fungitoxicity is enhanced by oxidation.



Leaf expansion in wheat and its wild relatives

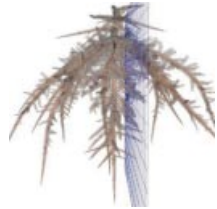
Rapid and early leaf area expansion is desirable in cereal crops of low-rainfall areas. **Bultynck *et al.* (pp. 99–108)** investigate leaf expansion rates in two wheat species and three wild relatives. One wild species is identified with leaf expansion rates similar to those of cultivated wheat but with higher a photosynthetic rate.



Genetic structure of sago palm

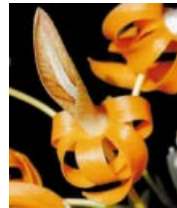
The genetic structure of sago palm (*Metroxylon sagu* Rottb.) within seven Papua New Guinean populations is investigated by **Kjær *et al.* (pp. 109–117)** using AFLPs. The genetic structure is

related to datasets involving morphology and geographical distribution, and conclusions are drawn on the taxonomy of *M.sagu*.



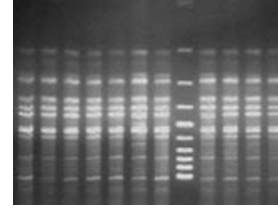
Applying fractal analysis to studying efficiency of soil exploration by roots

Relations between fractal analysis of roots and efficiency of soil exploration are assessed in simulations of roots, soil depletion volume, and competition by **Walk *et al.* (pp. 119–128)**. They explore correlations of soil exploration with fractal parameters calculated from whole root systems as well as two-dimensional slices and projections of roots.



Orchid pseudopollen – full stomachs or empty promises?

It was previously believed that the unusual labellar hairs of *Dendrobium unicum* attract pollinating insects by deceit since they appear to offer no food. However, **Davies and Turner (pp. 129–132)** show they probably act as food-providing pseudopollen and contribute to pollinator selection by containing more starch and less protein than in *Maxillaria* and *Polystachya* spp. while retaining aromatic amino acids.



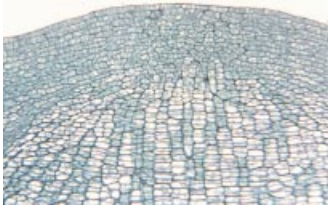
SSR variation in the endemic and endangered cycad

Knowledge of the genetic diversity of rare and endangered species plays a significant role in formulating appropriate management and conservation strategies. Using ISSR, **Xiao *et al.* (pp. 133–138)** uncover genetic variation in *Cycas* and give possible explanations for this. Their findings highlight that *in situ* conservation of *Cycas guizhouensis* should be a priority.



Phenological responses to temperature by *Lesquerella* species

The introduction of a new crop requires an understanding of environmental influences on development. Temperature has been recognized as a main factor affecting the rate of development in crops. **Windauer *et al.* (pp. 139–144)** describe how *Lesquerella fendleri* (annual) exhibits a quantitative response while *L. mendocina* (biennial) shows a qualitative response to supra-optimal temperatures.



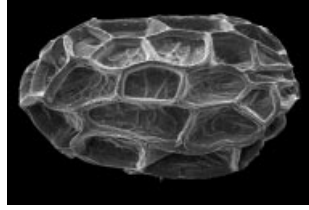
Giant shoot apical meristems produce giant cactus shoots

Cacti with very wide shoots have an enlarged cortex and pith produced by giant shoot apical meristems (up to 2565 μm in diameter). **Mauseth (pp. 145–153)** reveals that the zone comprising the central mother cells, peripheral zone and rib zone is greatly enlarged by huge numbers of cells. Such meristems could facilitate the mapping of gene expression domains.



Night temperature has little impact on growth in whole plants

Global temperatures are rising with much of the warming occurring at night. **Frantz et al. (pp. 155–166)** show that a range of night temperatures (17–34 $^{\circ}\text{C}$) have only small effects on the ability of groups of whole plants of lettuce, tomato and soybean to photosynthesize, respire and conserve carbon, when day temperatures remain unchanged at 25 $^{\circ}\text{C}$.



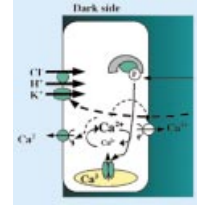
Micromorphological studies on seeds of *Orobanche*

Intrinsic taxonomic problems in the genus *Orobanche* are increased by the difficulty or impossibility of identifying key differential characters in dried specimens. **Plaza et al. (pp. 167–178)** highlight the usefulness of micromorphological studies on seeds of *Orobanche* in relation to differentiating taxa, and provide a key that enables species or groups of species to be distinguished by this means.



Cotton seedlings recover from thrips damage through accelerated leaf ontogeny

Although early season infestation by thrips commonly reduces leaf area of cotton seedlings, they often recover within a few weeks. **Lei and Wilson (pp. 179–186)** describe a novel mechanism to explain this. They find that seedlings gain additional leaf area by means of an accelerated termination of the growth of lower deformed leaves and earlier emergence of upper uninfected leaves.



Phototropic signalling in oat coleoptiles

Different stages of the blue light (BL)-induced phototropic signalling pathway in etiolated oat coleoptiles are investigated by **Babourina et al. (pp. 187–194)**. Continuous measurement of ion fluxes (Ca^{2+} , H^+ , K^+ and Cl^-) and bending response during unilateral BL exposure suggests that Ca^{2+} participates in the signalling stage of BL-induced phototropism. In contrast the phototropic bending response is linked instead to changes in the transport of H^+ , K^+ and Cl^- .